



Charge Question Interim Report Overview

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Purpose

- Take stock of the available information and forthcoming information that will inform responses to the charge questions
- Assess the confidence in their responses based on the quality, amount, and agreement of available evidence sources



Subgroups and Meetings

- Science Panel members participated on six subgroups from late August to late October:
 - Macrophytes and diatoms
 - Historical conditions
 - Sediments
 - Harmful Algal Blooms
 - Fish, Aquatic Life, and Birds
 - Criteria Development
- Science Panel received an overview of the charge question interim reports on October 20.



Report Format

- Background and Approach
- Charge Questions
- Question Evaluation
- Cited Studies and Analyses
- Forthcoming Studies and Analyses

Charge Question Interim Report Format



2.2. What are the environmental requirements for submerged macrophytes currently present at Utah Lake?

Evidence evaluation

General requirements for submerged macrophytes in freshwater systems include light availability, water level, appropriate sediment substrate, and sheltering from mechanical disturbance including wave action and ice heaving. Light compensation points for species documented in Utah Lake (*Ceratophyllum demersum*, *Elodea canadensis*, *Myriophyllum spicatum*, *Potamogeton pectinatus*, *Potamogeton praelongus*; Brotherson 1981, Miller and Crowl 2006, Landom et al. 2019) range from 3.5-45 $\mu\text{mol m}^{-2} \text{s}^{-1}$ (Madsen et al. 1991, Sand-Jensen and Madsen 1991, Spencer and Rejmanek 2010). *C. demersum*, a submerged macrophyte documented in the most recent report (Landom et al. 2019), was found to have a light compensation point of 7.2 $\mu\text{mol m}^{-2} \text{s}^{-1}$, within the range of compensation points for seven species ($6.9 \pm 1.9 \mu\text{mol m}^{-2} \text{s}^{-1}$; Sand-Jensen and Madsen 1991). Multiple factors impact light level in Utah Lake, including sediment resuspension, carp bioturbation, and phytoplankton shading. Modeling studies have also indicated that carp and epiphytic algae can act together to eliminate submerged macrophyte communities in lakes (Hidding et al. 2016), providing support for concurrent internal (carp removal) and external (nutrient loading reduction) efforts. Water clarity and benthic primary production models indicate a historical clear-water state, featuring a self-stabilizing submerged macrophyte community would likely require mean phytoplankton chlorophyll a concentrations $< 18 \mu\text{g/L}$ and mean Secchi depths of $\sim 1 \text{ m}$ (considering 2018 water levels), compared to 2018 mean chlorophyll concentrations of $40 \mu\text{g/L}$ and Secchi depths of 0.25 m (King 2019). A consideration that may impact these requirements is whether a given macrophyte species maintains biomass low to the ground, hence requiring light conditions to be maintained throughout the growing season, or if the species grows nearer to the water surface throughout the growing season and thus may only need requisite light conditions to be maintained at the start of the growing season.

Confidence

Evidence to evaluate this question is derived from a combination of observational studies in Utah Lake, theoretical modeling for Utah Lake, and experimental studies on specific macrophyte species. There is a high amount of information to answer this question, and the quality of this evidence ranges from medium (literature-derived information on specific taxa) to high (studies in Utah Lake) with high agreement. We conclude there is medium confidence in answering this question.

Interim Synthesis Statement

Given the available information, the SP has medium confidence that submerged macrophytes in Utah Lake require higher water clarity than currently exists in Utah Lake. Additional considerations that will impact macrophyte recovery in the lake include sediment substrate and sheltering from mechanical disturbance, which have not been evaluated in Utah Lake to date, as well as water level, which is evaluated as part of charge question 2.2.i.



Next Steps

- Revisit the charge questions in 2023 after future studies are completed
- Steering Committee review of interim charge questions



Steering Committee Review

- Send out the interim charge question reports ASAP
- Provide feedback and questions via a tracking spreadsheet
- Reconvene for a joint meeting between Science Panel and Steering Committee to discuss the reports, optimally scheduled for the mid to late January



QUESTIONS?